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**Tactical Control System (TCS)  
Systems Integration Contract**

**Industry Brief Document**



Program Executive Officer, Cruise Missiles Project  
and Unmanned Air Vehicles Joint Project

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Version 1

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## 1.0 Program Description

### ***Background***

The Office of Secretary of Defense (OSD) established an initiative to provide Joint war-fighting commanders with interoperable and scalable command, control, communications and data dissemination systems for the family of present and future MAE and tactical Unmanned Aerial Vehicles (UAVs). In response to this initiative the Program Executive Office for Cruise Missiles and Joint UAVs [PEO(CU)] has established a UAV Tactical Control System (TCS) acquisition program with a three phase acquisition strategy. Procurement of the TCS is an urgent requirement based on the need to provide UAV systems to operators supporting current military operations.

Use of information from the Predator (currently deployed in Bosnia) has been limited to the single ground control system built specifically for the Predator. This design is consistent with previous UAV programs. The TCS is being developed to eliminate the current approach of a unique control system for each different UAV. The TCS approach will reduce duplication of efforts and provide a significant reduction in development and operating costs. When deployed, the TCS will be interoperable with all future tactical UAVs, including the Predator (currently deployed) and the Outrider (currently under design and development) and will be capable of dissemination of critical data for planning, targeting and combat assessment to support joint services at multiple echelons.

The TCS program supports the war-fighter requirements in the Operational Requirements Document (ORD) Unmanned Aerial Vehicle - Tactical Control System dated 17 January 1997, validated by Joint Requirements Oversight Council Memorandum (JROCM) 011-97 dated 3 February 1997. This ORD identified the urgent need to provide a common tactical control system for the current and future family of tactical and MAE UAVs. The program is funded by the Defense Airborne Reconnaissance Office (DARO), which has designated the Navy PEO(CU) as the executing agent for the program. The Army, Navy, Air Force and Marine Corps are participating in the program. The TCS architecture is also being shared with North Atlantic Treaty Organization (NATO) armed services. NATO Project Group (PG) 35 (led by a US chairman) is leading the joint service integration effort in NATO for application of a UAV common, interoperable ground station architecture. In addition to the work which has been coordinated among members of PG-35, NATO has funded an industrial advisory group to produce the top level interoperable architecture for the NATO architecture which will be published by NATO (March 98).

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## Program Overview

### TCS Program Phases and Design Baselines

Acquisition of the TCS will be conducted in three phases (see figure 1-1). Phase I is defined as Program Definition and Risk Reduction. Phase II is defined as Engineering and Manufacturing Development and will consist of two tracks: 1) Low Rate Initial Production which the system integration contractor will be responsible for, and 2) continuing development which the Government will lead a government/industry team supported by the system integration contractor. Phase III is defined as Production, Deployment and Operational Support.

Phase I will produce a Block 0 design that will define the LRIP baseline. Phase II will result in a Block 1 design composed of the LRIP baseline combined with requirements generated from the continued development effort performed by the government/industry team. The Block 1 design will define the production baseline. Phase III will produce future Block designs of the TCS that support the addition of air vehicles, C4I interfaces and increased functionality. Figure 1-2 shows envisioned functionality growth in TCS Block designs.

**FIGURE 1-1 TCS SCHEDULE CONCEPT**

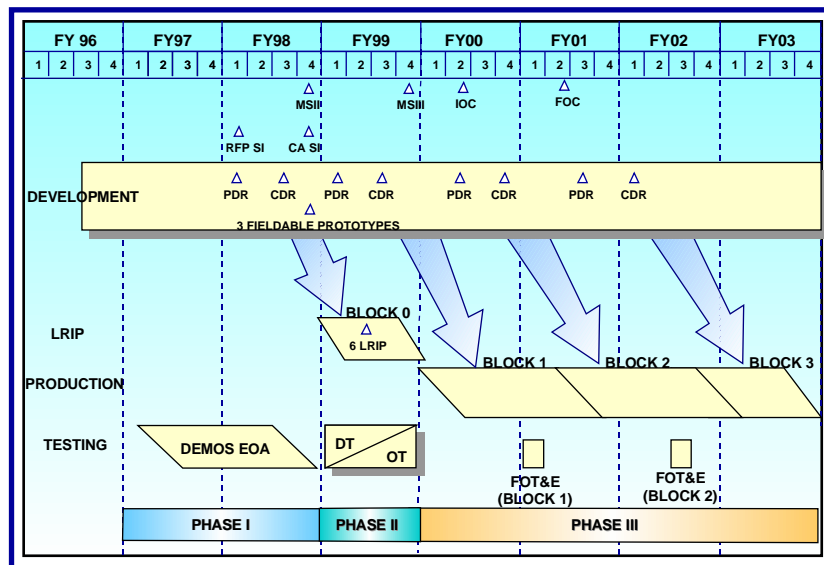
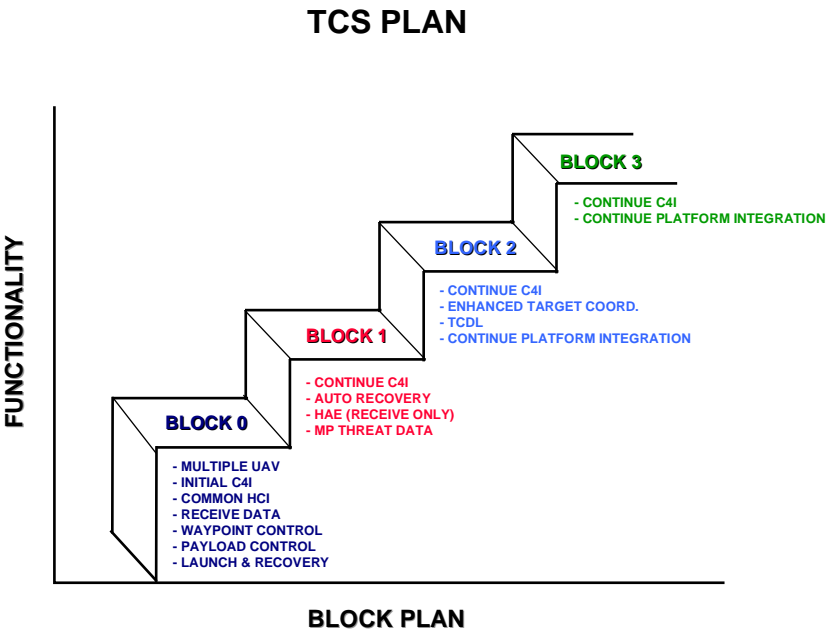


FIGURE 1-2 TCS BLOCK RELEASE CONCEPT



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## **Tactical Control System**

The TCS is the software, software-related hardware and the extra ground support hardware necessary for the control of the TUAV, the MAE UAV and future tactical UAVs. The TCS will also provide connectivity to specifically identified Command, Control, Communications, Computers, and Intelligence (C4I) systems. TCS will have the objective capability of receiving High Altitude Endurance (HAE) UAV payload information. Although developed as a total package, the TCS will be scaleable to meet the user's requirements for deployment. TCS will provide a common Human-Computer Interface (HCI) for tactical airborne platforms to simplify user operations, training, and facilitate seamless integration into the Services' joint C4I infrastructure.

### ***Software***

A major focus of the TCS program is software. The software will provide the UAV operator the necessary tools for computer related communications, mission tasking, mission planning, mission execution, data receipt, data processing, limited data exploitation, and data dissemination. The software will provide a high resolution computer generated graphics user interface that enables a UAV operator trained on one system to control different types of UAVs or UAV payloads with a minimum of additional training. The TCS will operate in an open architecture (scaleable, expandable) and be capable of being hosted on computers that are typically supported by the using Service. Software developed will be Defense Information Infrastructure - Common Operating Environment (DII-COE) compliant, non-proprietary, and the architectural standard for all future tactical UAVs. TCS will provide software portability, scaleable functionality, and support for operational configurations tailored to the users' needs.

### ***Hardware***

To the extent possible, the TCS will use standard Department of Defense (DOD) and Commercial Off The Shelf (COTS) components in order to achieve commonality. The TCS will use the computing hardware specified by the service specific procurement contracts. The individual armed services will identify TCS computing hardware, the desired level of TCS functionality, the battlefield C4I connectivity, and the particular type of air vehicle and payloads to be operated depending upon the deployment concept and area of operations. TCS hardware must be capable of being scaled or modularized to meet varying Service needs. The TCS hardware architecture will permit long range communications from one TCS to another, data storage expansion, access to other computers to share in processing capability, and multiple external peripherals.

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## ***System Compliance***

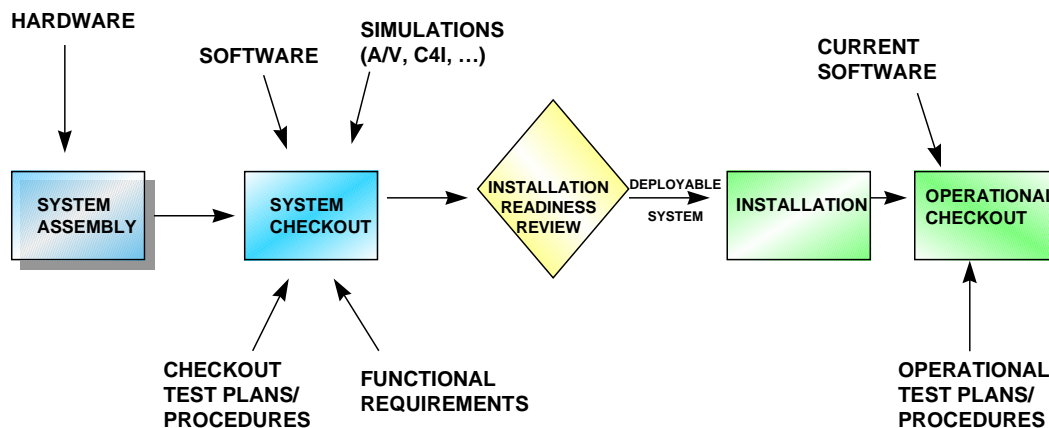
The TCS will be developed in compliance with the following military and commercial computing systems architecture, communications processing, and imagery architecture standards:

- a) Defense Information Infrastructure (DII) Common Operating Environment (COE)
- b) Computer Open Systems Interface Processor (COSIP)
- c) Common Imagery Ground/Surface System (CIGSS) Handbook
- d) Variable Message Format (VMF) and Joint Message Format (JMF)
- e) National Imagery Transmission Format (NITF)
- f) Assistant Secretary of Defense (ASD) (C3I) Joint Technical Architecture (JTA)

## **System Integration and Installation Process**

The system integration contractor will plan, schedule and perform the TCS integration and installation. This contractor will become part of the TCS government/industry team. In order to effectively perform within a diverse, multi-service team, the system integration and installation must follow a well defined process. Figure 1-3 shows a notional, high-level process for this effort.

**FIGURE 1-3 NOTIONAL SYSTEM INTEGRATION/INSTALLATION PROCESS**





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## 2.0 Work Outline Guidance

The purpose of the Work Outline is to provide an outline and structure for all documentation. A common numbering system based on a Work Outline will be used to integrate the elements of the contract. In particular, the contractor must ensure that the numbering system integrates the Task Description Document (section 3.0), Integrated Master Plan (section 4.0) and Integrated Master Schedule (section 5.0). This numbering system will be used throughout all program documentation.

This Work Outline guidance provides the structure for the TCS program. Contractors should add the System Integration effort to the level deemed necessary to capture the work required.

The first two levels of the TCS Work Outline are defined as follows:

### **TCS WBS**

1.0	Tactical Control System
1.1.0	Program Management
1.2.0	Systems Engineering
1.3.0	Hardware Development
1.4.0	Configuration Management
1.5.0	C4I Development
1.6.0	ILS/Training
1.7.0	System Test & Evaluation
1.8.0	Software Development
1.9.0	Data Link
2.0.0	System Integration

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## 3.0 TASK DESCRIPTION DOCUMENT (TDD) GUIDANCE

### ***Administrative Guidance***

Based on the guidance in this section, the contractor should prepare a Task Description Document that defines the tasks and work effort they will perform to complete their program. This Task Description Document guidance provides the contractor an example for development of the unique task descriptions. The guidance is not intended to be all inclusive. It represents minimum tasks that must be included in your program for consideration as each contractor develops their proposal.

### ***Detailed Tasks Guidance***

The following guidance is provided for the development of the TDD. This guidance represents the minimum work effort that the government considers necessary to complete the program.

### **Program Management**

The contractor shall perform program management of the system integration contract. This shall include disclosing cost/schedule status and management procedures to assure early identification and resolution of problems.

#### ***Cost/Schedule***

The contractor shall use a computer based cost/schedule performance management program to manage and track cost, progress and performance of the project.

#### ***Subcontract Management***

The contractor shall be solely responsible for the performance and quality of all subcontractor work performed in response to the requirements of this contract.

The contractor shall identify and monitor significant technical, quality, schedule and milestone achievement on a continuing basis, according to the contractor's own established subcontract management techniques. The contractor shall ensure contractual requirements are allocated down to the subcontractor level.

The contractor shall make provision for government representatives to participate in subcontractor visits, technical working groups/reviews and to observe testing/work in progress.

#### ***Associated Contractor Agreements (ACAs)***

The contractor shall identify all ACA requirements and methods.

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## **Program and Engineering Reviews**

As a minimum, the contractor shall perform the reviews listed below. As part of the program and engineering reviews, the contractor shall implement an action item tracking system that identifies action items, responsibility for completion, due dates, reviewing authority and status. An action item status report shall be submitted with the monthly progress report.

### ***Post-Award Review***

The contractor shall host a post award review within 30 days after contract award to confirm a common understanding of the contract terms and conditions.

### ***In Process Reviews (IPR)***

The contractor shall support all TCS Program IPRs. This support shall include a short status presentation of the system integration effort.

### ***Program Reviews***

The contractor shall conduct periodic program reviews. The program review will be conducted to provide the necessary visibility to the Government into the conduct and consequences of the various efforts by the contractor. The contractor shall provide an agenda to the Government prior to the review and shall produce meeting minutes. Copies of all presentation material shall be available at the review and will become part of the minutes. The topics for presentation and discussion at the program review shall include but are not limited to the following:

- Overall technical, schedule and cost status of the program (including subcontractor efforts).
- A brief overview and status of the program objectives.
- Updated contract schedule.
- Critical path analysis.
- System design issues.
- Summary program cost/financial data.
- Action item review.

### ***Installation Readiness Review***

The contractor shall perform an installation readiness review before each installation. The contractor shall present the planned installation configuration, system checkout results supporting the decision to proceed to installation, risk assessment and any outstanding program or technical issues concerning the installation.

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## ***Ad Hoc Reviews***

Additional meetings and reports may be required by unplanned events. These reviews shall be limited to a specific issue and may be initiated by either the contractor or the government. The contractor shall prepare and provide minutes.

## **Systems Engineering**

The contractor as the systems integrator shall perform the systems engineering functions appropriate to the systems integration and installation effort.

### ***Interface Management***

The contractor shall ensure the compatibility and interoperability between the internal hardware and software components, and the interfaces between the TCS and external systems specified in the contract specifications.

### ***TCS System Safety***

The contractor shall conduct a safety assessment including evaluation of the safety risks being assumed prior to test or operation of the system. Results of the assessment shall be presented at reviews.

### ***Producibility***

The contractor shall identify, develop and record the methods, processes and resources used to accomplish the integration and installation of the TCS. Elements of producibility shall be presented at reviews.

## **System Integration IPT**

The contractor shall establish and chair the System Integration IPT. The contractor shall produce an IPT charter and an IPT Integrated Master Plan (see section 4.0). The contractor shall be responsible for scheduling meetings; for providing the meeting space and administrative support; for distributing relevant documentation scheduled to be addressed during meetings; for conducting the meeting; for making decisions when they can be implemented within the scope of the IPT's charter and for controlling, updating and releasing the documentation reflecting the IPT's decisions. Membership shall include as a minimum, contractors who are providing hardware and software to be integrated into the TCS. Figure 4-1 depicts the TCS IPT structure. The System Integration IPT shall provide a representative to the System Engineering IPT.

## **Cross IPT Support**

The contractor shall support the TCS IPT structure and plan this support in the process IMP. The system integration contractor shall support the following IPTs:

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## ***System Requirements Analysis & Design***

The System Integration IPT shall participate in combining Block 0 LRIP baseline with the development effort to arrive at a Block 1 baseline. The System Integration IPT shall provide inputs to the System/Sub-system Design Document (SSDD) and the Hardware Performance Specification. The System Integration IPT shall act as a liaison between the system integration effort and development effort to ensure compatibility of the two for future block designs.

## ***System Development***

The System Integration IPT will receive guidance from the Hardware Performance Specification and the System Development IPT on the overall parameters of each configuration. The System Integration IPT shall provide lessons learned and suggest design modifications and enhancements as a result of the contractor system assembly effort.

## ***Software***

The System Integration IPT shall monitor the content of new software builds as they are released from the TCS Program. The System Integration IPT shall assess the new capabilities to determine if the new capabilities require modification of contractor test procedures and/or simulations.

## ***C4I Interface***

The System Integration IPT shall monitor the development of C4I interfaces. As new interface requirements are developed and the capabilities are included in new software builds, the System Integration IPT shall assess the need to modify simulations and test procedures to complete contractor testing.

## ***Data Link***

The System Integration IPT shall monitor the TCS/Data Links integration process to determine the impact on contractor testing. As new data links are introduced into TCS, data link simulations may have to be enhanced to include additional data link capabilities and/or requirements.

## ***Configuration Management (CM)***

The System Integration IPT shall review the TCS Configuration Management Plan and any other applicable documents. The System Integration IPT shall provide a plan describing the methodology, naming conventions, etc. to track the configurations of the systems delivered by the contractor. The System Integration IPT shall be represented in the software and hardware Assessment Review Boards.

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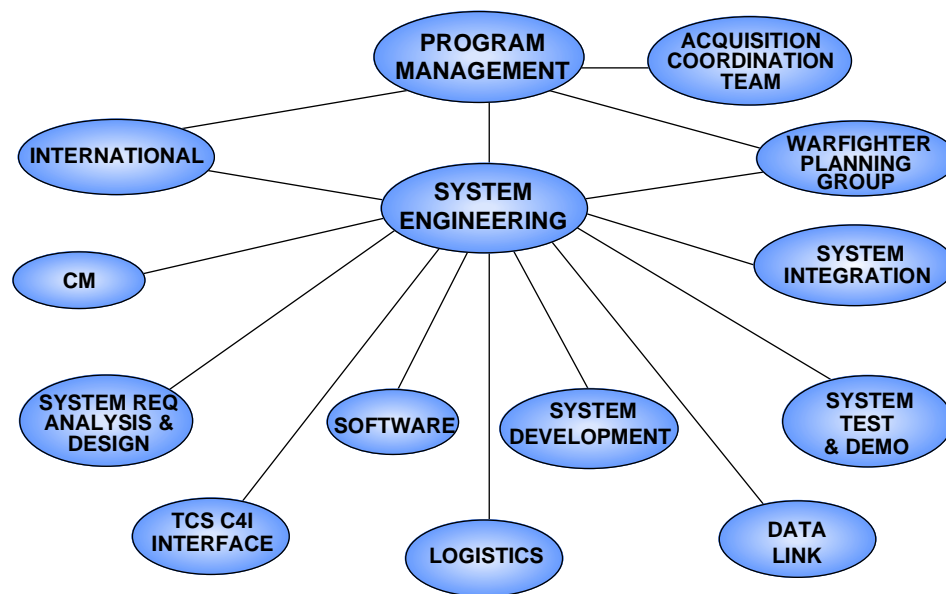
## ***Logistics***

The System Integration IPT shall review and comment (where appropriate) on the Integrated Logistical Support Plan (ILSP) and other documents as they become available. In addition, as the IPT monitors additional capabilities being added to TCS from the other IPTs, the System Integration IPT shall recommend changes to training courseware, operator manuals, technical manuals, etc. as appropriate.

## ***System Test & Demonstration***

The System Integration IPT shall monitor the Test and Demonstration schedule and work with the Test and Demonstration IPT lead to determine System Integration IPT support requirements. For tests and demonstrations requiring System Integration IPT support, the System Integration IPT lead shall provide the Test and Demonstration IPT lead with tasks, schedule, and milestones to support that event.

**FIGURE 4-1 TCS IPT STRUCTURE**



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## **Phase II Low Rate Initial Production (LRIP)**

The contractor shall integrate and install six Block 0 LRIP systems. These systems will be used to conduct DT/OT for all of the services.

### ***Plan and Schedule Integration and Installation***

The contractor shall plan and schedule the lab integration and operational installation of the LRIP systems considering as a minimum:

- TCS Program Office identified priorities,
- operational asset availability (e.g., ships),
- configuration description, and
- air vehicle Datalink Control Module (DCM) delivery schedules.

### ***Lab Integration***

The contractor shall integrate GFE hardware (workstations, HMMWVs, datalinks, etc.) with GFE software (Core, DII/COE, C4I specific, etc.) and with contractor procured software/hardware (as required) in accordance with the GFI Block 0 design documentation (SSS, IDD, etc.) into a deployable system ready for installation.

### ***Lab Checkout***

For each system, the contractor shall conduct system level tests to demonstrate that the system meets the applicable performance requirements. The government will provide tactical software and appropriate simulators. The government will also provide the functional requirements appropriate for the class of installation. The contractor shall develop test plans and test procedures as required by the functional requirements.

### ***Operational Installation***

The contractor shall transport the integrated systems from the laboratory checkout site to the operational installation sites designated by the TCS Program Office. The contractor shall install the system (IAW the operational installation plan) into the following service entities:

- 2 Integrated ship-based TCSs
- 1 HMMWV-based TCS
- 1 TOC-based TCS
- 1 back-fit Predator system
- 1 back-fit Outrider system

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## ***Operational Checkout***

The contractor shall conduct an operational system checkout in accordance with the Operational Test Plan. This test plan shall include procedures for connecting to the applicable C4I systems in a manner defined in the appropriate IDD or the Standard Operating Procedure (SOP) of the designated operational unit. For systems being delivered for a Level 2 interaction, the contractor shall determine a test methodology and appropriate test procedures for the downlink of air vehicle(s) data and payload(s) data, without the use of an air vehicle. For systems being delivered for a Level 3 or greater interaction, the contractor shall determine a test methodology and appropriate test procedures for the uplink and downlink of air vehicle(s) data and payload(s) data, without the use of an air vehicle.

## ***Define and Document Installation Data Packages***

The contractor shall define and document the LRIP installed configurations (including cabling and additional hardware) and interfaces to include installation procedures. For the Predator and Outrider systems, this documentation should be in the form of back-fit ECPs.

## ***Support Formal Testing***

The Phase II LRIP systems will be used for DT/OT. The contractor will support this formal testing.

## **Phase III Production**

The contractor shall integrate and install production TCS's. These systems will also be used to conduct FOT&E.

## ***Plan and Schedule Integration and Installation***

The contractor shall plan and schedule the lab integration and operational installation of production TCSs considering as a minimum:

- Predator and Outrider fielding plans,
- service identified priorities,
- operational asset availability (e.g., ships),
- configuration description, and
- air vehicle Datalink Control Module (DCM) delivery schedules.

## ***Lab Integration***

The contractor shall integrate GFE hardware (if appropriate) with the GFE software (Core, DII/COE, C4I specific, etc.) and with contractor procured software/hardware (as required) in accordance with the GFI Block design documentation (SSS, IDD, etc.) into a deployable system ready for installation.



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## ***Lab Checkout***

For each system, the contractor shall conduct system level tests to demonstrate that the system meets the applicable performance requirements. The government will provide tactical software and appropriate simulators. The government will also provide the functional requirements appropriate for the class of installation. The contractor shall develop test plans and test procedures as required by the functional requirements.

## ***Operational Installation***

The contractor shall transport the integrated systems from the laboratory checkout site to the operational installation sites designated by the TCS Program Office. The contractor shall install 206 production TCS nodes IAW the operational installation plan. Current plans call for:

- 86 Predator and Outrider
- 120 service Identified

## ***Operational Checkout***

The contractor shall conduct an operational system checkout in accordance with the Operational Test Plan. This test plan shall include procedures for connecting to the applicable C4I systems in a manner defined in the appropriate IDD or the Standard Operating Procedure (SOP) of the designated operational unit. For systems being delivered for a Level 2 interaction, the contractor shall determine a test methodology and appropriate test procedures for the downlink of air vehicle(s) data and payload(s) data, without the use of an air vehicle. For systems being delivered for a Level 3 or greater interaction, the contractor shall determine a test methodology and appropriate test procedures for the uplink and downlink of air vehicle(s) data and payload(s) data, without the use of an air vehicle.

## ***Define and Document Installation Data Packages***

The contractor shall define and document the installed configurations (including cabling and additional hardware) and interfaces to include all procedures required to accomplish these installations.

- Predator Back-Fit, Forward-Fit ECPs - For Predator systems that have already been purchased, the contractor shall develop a back-fit Engineering Change Proposal (ECP) which will make those systems TCS compliant. The contractor shall develop forward-fit ECPs for new Predator TCS nodes.
- Outrider Back-Fit, Forward-Fit ECPs - For Outrider systems that have already been purchased, the contractor shall develop a back-fit Engineering Change Proposal (ECP) which will make those systems

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TCS compliant. The contractor shall develop forward-fit ECPs for new Outrider TCS nodes.

- Ship Install Data Package - The contractor shall develop a data package for the integration and installation of the TCS onboard ship.
- HMMWV Install Data Package - The contractor shall develop a data package for the HMMWV installation of the TCS.
- TOC Install Data Package - The contractor shall develop a data package for the TOC installation of the TCS.

## ***Support Formal Testing***

The System Integration shall support FOT&E.

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## 4.0 Integrated Master Plan (IMP) Guidance

The contractor should develop a comprehensive IMP which describes the System Integration effort. The IMP will be reviewed at formal reviews to ensure that scheduled events have been accomplished and that future planning is still sound. The IMP should be consistent with the TCS IPT structure. A common numbering system based on the Work Outline guidance (section 2.0) will be used to integrate the IMP with the Integrated Master Schedule (section 5.0). The IMP is divided into two sections: the Product IMP and the Process IMP. Preparation instructions for these two sections follows.

### ***Product IMP Guidance***

The product IMP should contain significant events necessary to complete the system integration effort. It should provide insight into your detailed plans to accomplish major program events. The contractor should define the specific criteria that must be satisfied for these major events to be considered complete. Key elements should be provided in an easy to read table format.

Key elements of the product IMP and their definition are:

#### **Event**

- The conclusion/initiation of an interval of major program activity (i.e., Integration Complete).
- Decision oriented maturation events (i.e., Ready for Installation).
- Events need not be sequential.
- The number of events should increase for lower levels.

#### **Significant Accomplishments**

- Desired result at a specified event which indicates a level of design maturity (or progress) directly related to each product/process.
- Discrete step in the progress of the planned effort.
- Describes functional interrelationships of different disciplines applied to the effort (i.e., System Checkout).
- Must be event related -- not just time coincident.

#### **Accomplishment Criteria**

- A quantitative measure/indicator that the level of maturity (or progress) has been achieved.
- Work effort completions that ensure closure of an accomplishment.

### ***Process IMP Guidance***

The process IMP is used to describe the technical, management and business processes that the contractor plans to apply to the System Integration effort. It should provide visibility into the contractor's key processes/procedures and

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provide an overview of the efforts required to implement them. Key elements of the process IMP are:

**Statement of Objectives:** State the objective of the process/procedure.

**References:** The contractor may cite their own existing internal procedures and systems.

**Approach:** State how you will interface with the TCS IPT structure to meet the program objectives.

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## **5.0 Integrated Master Schedule (IMS) Guidance**

The contractor shall provide the system integration effort input to the TCS IMS. The contractor's schedule shall provide the major system integration milestones, detailed tasks to support each milestone (including WBS elements), the amount of calendar time required to complete each task, and the personnel loading for each task. The government will provide the input format. A common numbering system based on the Work Outline guidance (section 2.0) will be used to integrate the IMS with the Integrated Master Plan (section 4.0). The contractor may provide additional elements if deemed necessary to clarify or add value to the schedule.

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## 6.0 Acronym List

ACRONYM	Alphabetically Concatenated Rearrangement Of Names Yielding Meaning
ACA	Associate Contractor Agreement
ASD	Assistant Secretary of Defense
C3I	Command, Control, Communications and Intelligence
C4I	Command, Control, Communications, Computers and Intelligence
CIGSS	Common Imagery Ground/Surface System
COSIP	Computer Open System Interface Processor
COTS	Commercial Off The Shelf
DARO	Defense Airborne Reconnaissance Office
DCM	Datalink Control Module
DII-COE	Defense Information Infrastructure - Common Operating Environment
DOD	Department Of Defense
ECP	Engineering Change Proposal
FOT&E	Follow On Test & Engineering
GFE	Government Furnished Equipment
GFI	Government Furnished Information
HAE	High Altitude Endurance
HCI	Human Computer Interface
HMMWV	High Mobility Multi-purpose Wheeled Vehicle
IDD	Interface Design Document
ILSP	Integrated Logistics Support Plan
IMS	Integrated Master Schedule
IPD	Integrated Product Development
IPR	In Process Review
IPT	Integrated Product Team
JMF	Joint Message Format
JROCM	Joint Requirements Oversight Council Memorandum
JTA	Joint Technical Architecture
LRIP	Low Rate Initial Production
MAE	Medium Altitude Endurance
NITF	National Imagery Transmission Format
ORD	Operational Requirements Document
OSD	Office of the Secretary of Defense
PEO(CU)	Program Executive Office (Cruise Missiles Project and UAV Joint Project)
PG	Project Group
SSDD	System/Subsystem Design Document
SSS	System/Subsystem Specification
TCS	Tactical Control System

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TDD	Task Description Document
TOC	Tactical Operations Center
TUAV	Tactical Unmanned Aerial Vehicle
UAV	Unmanned Aerial Vehicle
VMF	Variable Message Format
WBS	Work Breakdown Structure